

1.027,712



## PATENT SPECIFICATION

DRAWINGS ATTACHED

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## COMPLETE SPECIFICATION

Improvements in or relating to Welding of  
Polytetrafluoroethylene

We, BTR INDUSTRIES LIMITED, a British Company, of Herga House, Vincent Square, London, S.W.1, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

The invention relates to the welding together of two bodies of polytetrafluoroethylene.

The invention provides the method of securing together two bodies of polytetrafluoroethylene which comprises the steps of supporting the bodies spaced apart a small distance, filling the space with compacted unsintered polytetrafluoroethylene powder and then heating the powder to above the sintering temperature of the powder.

In one form of the invention the powder is compacted *in situ* between the polytetrafluoroethylene bodies.

In another form of the invention the space is filled by a pre-formed member of compacted polytetrafluoroethylene powder, the member if necessary being further compacted into the space.

Preferably the powder is sintered under pressure. This pressure may, for example, be produced by natural expansion of the powder during the heating, between the supported polytetrafluoroethylene bodies.

The temperature to which the polytetrafluoroethylene powder is heated may be within the range of 620°F. to 930°F. and preferably from 680°F. to 750°F.

In a modified form of the method the polytetrafluoroethylene powder is replaced by fluorinated ethylene propylene powder which is heated to the sintering or melting temperature of the powder.

It is preferred to use the unsintered powder by itself but it is within the invention to incorporate in the powder a filler or pigment such as carbon black. When such an addition

is made, the proportion is preferably small, e.g. not greater than about 5%, although larger proportions can be used.

A specific application of the method according to the invention will now be described by way of example and with reference to the accompanying drawing which shows, in section, one stage in the welding together of the ends of a lining and covering of polytetrafluoroethylene for a metal dip pipe.

In the drawing, the pipe 7 is of steel and is provided with a lining sleeve 6 and an outer cover sleeve 5, both of polytetrafluoroethylene. The ends of the two sleeves extend beyond the end, 8, of the steel pipe, and are welded together by the method of the invention.

The first step in the welding operation is to support the sleeves by a closely fitting inner metal tube 1 and a closely fitting outer tube 3. The space 2 between the two sleeves is then filled with unsintered polytetrafluoroethylene powder which is firmly compacted, by tamping, to exclude air. The tube 1 is then removed and replaced by a tube of slightly smaller outside diameter. For example, if the tube 7 has an internal diameter of 2 inches and the wall thickness of the lining sleeve 6 is about 0.060 inches, then the replacement tube may leave a clearance of about 0.030 inches from the lining sleeve, all round. The whole assembly is then placed in an oven and heated to a temperature above the sintering temperature of the powder, whereby the powder is caused to cohere and also to adhere to the two sleeves. During the heating step the powder expands within the space 2 and as a result is compressed between the support tubes 1 and 3 which improves the adhesion. The provision of the clearance limits the pressure by allowing limited separation of the sleeves to increase the space between them either before or during the heating. After removal from the oven and cooling, the extreme end of the polytetrafluoroethylene

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assembly is cut off (e.g. on the line X—X) to produce a square end to the assembly.

The invention is not limited in its application to tubular structures. It may, for instance, be applied to the securing together of sheets, slabs or blocks held apart, the gap being filled with powdered polytetrafluoroethylene which is subsequently sintered. Such an application may be used for sealing the edges of metal sheets faced with sheets of polytetrafluoroethylene.

Furthermore the invention is not limited to filling the space with polytetrafluoroethylene in powder form. It is within the invention first to compress powder into a pre-formed member of size and shape substantially to fill the space (i.e. an annulus in the case of the above example) and to insert this member into the space. If desired or necessary, the member may then be tamped to ensure the space is completely filled or further powder may be added.

It is also within the invention to incorporate mineral fibres (e.g. of glass) in the powdered polytetrafluoroethylene as a reinforcement. These fibres may be separate, matted or woven and they may be coated with polytetrafluoroethylene before incorporation in the powder.

#### WHAT WE CLAIM IS:—

1. The method of securing together two bodies of polytetrafluoroethylene which comprises the steps of supporting the bodies spaced apart a small distance, filling the space with compacted unsintered polytetrafluoroethylene powder and then heating the powder to above the sintering temperature of the powder.
2. The method according to claim 1 in which the powder is compacted *in situ* between the polytetrafluoroethylene bodies.
3. The method according to claim 1 in which the space is filled by a pre-formed member of compacted polytetrafluoroethylene powder, the member, if necessary, being further compacted into the space.
4. The method according to any one of the

preceding claims in which the powder is sintered under pressure.

5. The method according to claim 4 in which the pressure is produced by natural expansion of the powder during the heating, bodies.

6. The method according to claim 4 in which the space between the bodies is increased after compacting the powder or is allowed to increase, during the heating, to limit the pressure produced.

7. The method according to any one of the preceding claims applied to the securing together of two polytetrafluoroethylene sleeves constituting respectively a lining and a covering for a metal tube and extending beyond one end of the tube in which, where the sleeves extend beyond the tube, the lining is supported internally, the covering is supported externally, the space between the sleeves corresponding to the thickness of the metal tube is filled with compacted unsintered polytetrafluoroethylene and powder and the whole is heated to sinter the powder.

8. The modification of the method according to any one of the preceding claims in which the polytetrafluoroethylene powder is replaced by fluorinated ethylene propylene powder which is heated to the sintering or melting temperature of the powder.

9. The method of securing together two bodies of polytetrafluoroethylene substantially as herein described.

10. The method of securing together the ends of a lining and covering of polytetrafluoroethylene for a tube, substantially as herein described with reference to and as shown in the accompanying drawing.

11. Two bodies of polytetrafluoroethylene united by the method according to any one of the preceding claims.

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COMPLETE SPECIFICATION

1 SHEET

*This drawing is a reproduction of  
th Original on a reduced scale*

